Original Article

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Pathology Section

Assessment of Mean Platelet Volume in Type 2 Diabetes Mellitus and Prediabetes

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ABSTRACT

Introduction: Platelet functions have important roles in the development of vascular complications in diabetic patients. Increased activity has been noted in Platelets with increased volume when compared to smaller ones, thus highlighting the utility of Mean platelet volume as a marker of platelet activity.

Aim: To evaluate MPV in patients with type II DM in comparison with a healthy control group and prediabetes group.

1. To study the correlation between MPV and vascular complications.

2. To understand the association of MPV with fasting blood glucose levels and duration of disease.

Settings and Design: Descriptive and prospective study.

Materials and Methods: A total of 77 patients with type II DM, 25 prediabetes subjects, and 38 healthy subjects attending a teaching hospital of Bangalore constituted the study population. The study subjects were evaluated by performing Complete blood count including MPV, Fasting Blood Glucose levels and Lipid profile. The diabetic subjects were interviewed for duration of disease and examined for presence of microvascular and macrovascular complications apart from noting the HbA1C levels. Mean platelet volume was compared between diabetic patients, prediabetes and healthy counterparts. Within the diabetic group, MPV was compared between this and without vascular complications. The exclusion criteria employed in the study was subjects with anaemia (Hb<11g/dl for females and Hb<12g/dl for males) and thrombocytopenia (<1.5 lakh/µL).

Statistical Analysis Used: Statistical evaluation was performed using Pearson correlation test (r value as the coefficient) from which the p value was calculated. Data was expressed as mean +/- standard deviation. A p-value <0.05 was considered statistically significant.

Results: MPV of diabetic patients was not significantly different when compared to prediabetes and non-diabetic individuals. Similarly, the MPV had no significant relation to FBS, PPBS, HbA1c and Body mass index. MPV had an inverse relationship with the platelet count.

Conclusion: MPV of diabetic patients was not significantly different when compared to prediabetes and non-diabetic individuals. Though the MPV in Diabetics with complications was higher than those without complications, it was not statistically significantly. Further studies are needed to evaluate the utility of MPV in Diabetes Mellitus.

Keywords: Platelet indices, Vascular complications in Diabetes Mellitus

INTRODUCTION

Diabetes mellitus (DM) is a global health problem with DM related deaths occurring due to the increased risk of developing atherosclerosis and the various disturbances at the cellular as well as metabolic levels [1,2].

Platelets express procoagulant proteins such as P-selectin and glycoprotein IIIa on their surfaces [3].

Large platelets contain denser granules that are metabolically and enzymatically more active than smaller ones thus having higher thrombotic potential. This might be the basis of the link between increased MPV and increased thrombotic potential [4]. A relationship between the presence of vascular complications in DM and MPV has been suggested by several studies. Prediabetes is generally defined as Impaired fasting glucose (IFG) levels, Impaired glucose tolerance (IGT), or both [5].

Pre-diabetes is a preclinical stage in the hyperglycemia spectrum in which subjects are at high risk of not only developing diabetes but also adverse cardiovascular events (myocardial infarction, stroke or cardiovascular death) in the later life [6]. The aim of the present study was to evaluate MPV in patients with type II DM in comparison with a healthy control group and prediabetes group, the determination of the association between MPV and vascular complications,

the estimation of the correlation between MPV and HbA1c, fasting blood glucose and duration of diabetes.

MATERIALS AND METHODS

The study was descriptive and prospective conducted in the February 2016 for the duration of 1 month, on 140 consecutive subjects attending a teaching hospital of Bangalore. Of the 140 subjects, 77 were known diabetics, 25 had pre-diabetes subjects while there were 38 healthy subjects without known coronary artery disease. The exclusion criteria employed in the study was subjects with anaemia (Hb<11g/dl for females and Hb<12g/dl for males) and thrombocytopenia (<1.5 lakh/µL).

After obtaining consent from all patient, all the subjects were evaluated clinically and the following tests were conducted: Complete blood counts including MPV, fasting blood glucose level and lipid parameters. In addition duration of diabetes and HbA1C level, presence of microvascular and macrovascular complications were noted for the diabetic and prediabetic subjects. MPV was compared between diabetic patients, pre-diabetic subjects and healthy counterparts. Within the diabetic patients MPV was compared between the ones with and without microvascular and macrovascular complications.

Laboratory Examinations

The complete blood count, fasting blood glucose level, lipid parameters and HbA1c of the subjects were studied after overnight fasting. MPV was performed on EDTA sample from venous blood within 2 hours of collections. The blood glucose was estimated by the glucose oxidase method.

Ethics

The study was approved by the institution ethics committee.

STATISTICAL ANALYSIS

Statistical evaluation was performed using Pearson correlation test (r value as the coefficient) from which the p value was calculated. Data was expressed as mean +/- standard deviation. A p-value <0.05 was considered statistically significant.

RESULTS

There were 43 male diabetics and 34 female diabetics in the study (77 in total). There were 16 non diabetic males and 22 non diabetic females in the study (38 in total) There were 13 prediabetic males and 12 prediabetic females (25 in total). The mean age of the diabetic population was 52 years, prediabetics (43 years) whereas that of non diabetic population was 41 years [Table/Fig-1]. The mean duration of diabetes was 4 years. Out of the 77 diabetics, 16 (21 %) had complications such as hypertension, peripheral neuropathy, autonomic neuropathy, diabetic foot, diabetic retinopathy, diabetic nephropathy, coronary artery disease, peripheral vascular disease, hypertriglyceridemia, and hypercholesterolemia and 61 (79 %) did not have any of these complications. The mean BMI in the diabetic group was 26 kg/m^2 whereas it was 24.6 kg/m^2 in the prediabetic group and 22.7kg/m^2 in the non diabetic group (p=0.321). The mean FBS level in the diabetic population was 231 mg/dL, 117mg/dl for the pre diabetic group while that of the non diabetic group was 93.15 mg/dL (p < 0.001).The mean platelet count in diabetics (2.59 lakhs) was lower than that of prediabetics (2.7 lakhs) (p=0.16) and non diabetics (2.7 lakhs) (p=0.128). However, the results were not significant

Age groups	Diabetics	Prediabetes	Non Diabetics
Number	77	25	38
Age (years)	52 +/- 11.9	43+/- 15	41+/- 14
Male (%)	43(55%)	13 (52%)	16 (42%)
Female (%)	34 (45%)	12 (48%)	22 (58%)
Mean duration of diabetes (years)	4 +/- 5.6	-	-
Macro/ micro complications (Number of patients)	16 (21%)	-	-
Height (cm)	156 +/- 4.1	158 +/- 3.4	162 +/- 2.9
Body mass (kg/m^2)	26 +/- 3.2	24.6 +/- 2.7	22.7 +/-2
Weight (kg)	64 +/- 9	61 +/- 5	59 +/- 4
FBS (mg/dl)	231+/- 78	117 +/- 4	93 +/- 11
PPBS (mg/dl)	321 +/- 59	129 +/- 3	115 +/- 9
HbA1C (%)	9.5 +/- 2.8	5.6 +/- 0.1	5.0 +/- 0.4
Hb% (gm%)	13.1 +/- 2.5	13.5 +/- 2.7	14.4 +/- 3.3
Platelets (x10^9/L)	2.5 +/- 0.5	2.7 +/- 0.9	2.7 +/- 0.9
Mean Platelet Volume (fl)	9.48 +/- 0.8	9.4 +/- 1.01	9.34 +/- 0.8

[Table/Fig-1]: Comparison of various parameters between Diabetics, Prediabetes and Non-Diabetics.

Characteristic		r-value	p-value
MPV	Duration of DM	-0.0535	0.5339
MPV	BMI	0.143	0.091
MPV	HbA1C	0.115	0.176
MPV	FBS	0.113	0.183
MPV	PPBS	0.167	0.236
MPV	Platelet count	-0.378	0.001
MPV	Age	-0.224	0.007

[Table/Fig-2]: Comparision of MPV to various parameters.
p-value less than 0.05 is not significant

statistically. The mean MPV in diabetics (9.48fl) was not significantly different from prediabetes (9.40fl) (p=0.685) and non diabetics (9.34fl) (p=0.794). The MPV in diabetics with macrovascular complications (9.58) was higher than those without any complications (9.46) [Table/Fig-2]. The results were statistically not significant (p=0.576).

DISCUSSION

Diabetes mellitus is a chronic disease that causes increased morbidity and mortality due to its vascular complications. There is a need to develop risk factor modification to reduce the impact of complications.

There is increased risk of thrombosis and atherogenesis in diabetic patients. Changes in hemostatic balance has been an important pathogenetic factor contributing to development of complications in DM. Many studies which focused on the role of platelets in maintain haemostatic balance in diabetic patients have reported increase in thrombotic adhesion, aggregation and secretion [7,8]. It is the need of the hour to prevent vascular complications and monitor the diabetic patients as the vascular burden increases day by day. Impaired insulin secretion and increased tissue resistance is the hallmark of Type 2 DM [9].

A series of interrelated alterations occur following sustained hyperglycaemia which cause endothelial dysfunction and vascular lesions leading to complications in diabetics [10].

Formation of advanced glycation end products, activation of protein kinase C and disturbances in polyol pathways are the possible mechanisms by which increased glucose induces vascular abnormalities [11]. The prevalence of diabetic microvascular complications is higher in people with poor glycemic control, longer duration of DM, associated hypertension, and obesity [12].

The mean platelet count in non diabetes was identical to the prediabetes group and higher when compared to the diabetic group. Similar observation was found in the study by Hemkimsoy et al., [13]. In contrast, the platelet count in diabetics was higher than in non diabetics in the study by Kodiatte et al., [14]. Several variables such as mean platelet survival, platelet production rate and turnover rate in DM can affect the platelet count.

MPV of diabetic patients was not significantly different when compared to to prediabetes and non-diabetic individuals. The MPV was higher in diabetics with complications than those without complications although it was not significant statistically. Our findings are consistent with the study by Giovanetti et al., [15] who did not find significant variation in the platelet indices to suggest the existence of effects due to diabetes mellitus.

MPV in the present study was not associated with duration of diabetes, Body mass index, HbA1c, Fasting blood sugar and postprandial blood sugar. Our findings are similar to the study by Yenigün et al.,[16] who found no association between MPV and HbA1C, FBS, Patient age and duration of diabetes. In the study by Kodiatte et al., there was significant statistical correlation between MPV and duration of diabetes [14] while in the study by Jindal et al., [7], platelet indices especially Platelet derived width (PDW) were different between diabetics and controls as well as those diabetics with and without microvascular complications.

Platelets play a pivotal role in atherothrombosis, the major cause of most unstable coronary syndromes and increased MPV levels have been shown as an indicator in myocardial infarcts [4,17], obesity [18] and hypertensive patients [19,20].

The MPV was not significantly higher in prediabetes when compared to non diabetics. This is in contrast to the study by Aclan Ozder wherein MPV as higher in patients with prediabetes when compared to normal subjects [6].

The MPV in men was higher (9.54 +/- 0.8) when compared to women (9.34 +/- 0.7).This is in contrast to the study by Giovanetti et al., [15].

An inverse relation was identified between MPV and the platelet count. Similar observation was made in the study by Glovanetti et al., [15].

The association between increased platelet volume and decreased platelet count [21,22] could be a result of small platelets being consumed in order to maintain a constant platelet functional mass [23]. Papanas et al., have noted higher MPVs in diabetic subjects who had associated microvascular complications including retinopathy [24].

Associations of platelet indices has also been shown with inflammation, disease activity of inflammatory disorders and response to anti inflammatory therapies [25].

LIMITATIONS

Further studies are needed to evaluate the utility of Mean Platelet Volume in diabetes mellitus. One of the limitation of our study was a relatively small sample size and the study was from a single institution thus can't be generalised to the entire population.

CONCLUSION

Mean Platelet Volume of diabetic patients was not significantly different when compared to prediabetes and non-diabetic individuals. Though, the Mean Platelet Volume in diabetics with complications was higher than those without complications, it was not statistically significantly. An inverse relationship was noted between Mean Platelet Volume and platelet count.

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